

became better defined, and centered in Indiana on the morning of November 15, while pressure in the Gulf and South Atlantic States also increased somewhat. The weather map on the morning of November 14th indicated conditions favorable for local thunderstorms in this section, and forecast was made accordingly. During the afternoon of November 14, thunderstorms, attended by light to heavy hail occurred in a strip of territory extending from Pickens County, Ala., southeastward across the State to Barbour County, Ala. The hailstones ranged from about the size of buckshot to as large as a baseball, the largest weighing as much as a pound. In the area mentioned the maximum temperatures for the day ranged between 73 and 83.

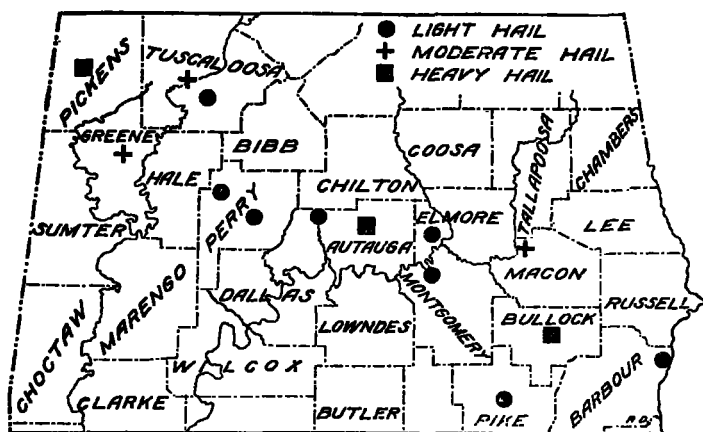


FIG. 1.—Portion of Alabama showing occurrence of hail-storms.

Material damage was done by the hailstones to paper roofing, windows, skylights, etc., and some poultry and live stock were killed, and a few persons slightly to badly injured. The damage was greatest in the vicinity of Reform, Pickens County; Vida, Autauga County, and Union Springs, Bullock County.

The following are extracts from a few of the reports received from correspondents:

*Reform, Pickens County, Ala.*—Montgomery (Ala.) Journal, Associated Press. Hailstones as large as baseballs and weighing a pound each in some instances, fell here late in the afternoon of the 14th. Damage estimated at \$5,000 was done in this vicinity. In the mill village composition roofing was torn off houses and occupants in some instances had to move out. Thirty-two windows were broken out of the county high school.

*Reform, Pickens County, Ala.*—S. K. Dorroh's report: All the paper roofing in town is being repaired. A lot of the hailstones were as large as hen eggs.

*Eutaw, Green County, Ala.*—Correspondent's report: Three separate storms of hail about half hour apart; continuous rain from 2:30 p. m. to 4:30 p. m. Hail fell about 10 minutes each time. No damage except to roofing.

*Tuscaloosa, Tuscaloosa County, Ala.*—Mrs. Kate T. Willingham's report: Hailstorm came from northeast. Hail about the size of partridge eggs, approximately lasted 20 minutes. After a cessation of about 15 minutes stones came from due north, with hail stones as large as hen's eggs, largest weighing one fourth pound. After cessation of about 10 minutes storm came from northwest, with hail smaller than second storm and not so intense, but wind much stronger than other two storms. No damage except to glass.

*Prattville, Autauga County, Ala.*—Report to Montgomery Journal: The stones were so large and heavy glass windows were reported broken and limbs of trees were cut off. It was declared to be the most extraordinary hail in size ever seen here.

*Mountain Creek, Chilton County, Ala.*—Mr. J. T. Culpepper's report: Hail in balls, size from buckshot to larger than goose eggs, some weighing 1 pound or more. Gardens were damaged; also slight damage to fruit and other trees, and some stock slightly injured by hail.

*Milstead, Macon County, Ala.*—Mr. W. U. Wall's report: On November 14 Milstead was visited by a heavy hailstorm in which there were stones as large as hen's eggs; paper roofing was damaged, and in some instances window glass broken. Approximate amount of damage, \$500.

*Union Springs, Bullock County, Ala.*—Mr. R. W. West's report: The writer viewed the unusual condition from the northeast, and indications pointed to extraordinary atmospheric conditions and without doubt an unusual windstorm, which may have reached proportions of a tornado. Others viewed very much the same conditions in southwest. Wind was not very strong, except at apparently a high altitude. The hailstones covered the ground, and were from 4 inches to 8 inches in circumference. The principal damage was to composition roofs, skylights, and window panes, all of which was done by hailstones.

*Union Springs, Bullock County, Ala.*—Mr. S. P. Rainer's report: It thundered, with lightning, all night. Some stock was killed. The ground was covered with hailstones. The stones were from 1 inch to 8 inches in circumference. It was the worst hailstorm I ever saw.

*Union Springs, Bullock County, Ala.*—Mr. P. L. Cowan's report: Very heavy hailstorm at 6:30 p. m., November 14. The largest hailstones measured 7 inches in circumference. The gross damage in this community from hail, rain, and wind will amount to about \$600 or \$800.

*Vida and White City, Autauga County, Ala.*—Report of Mr. Claude B. Smith, Prattville, Ala.: The storm occurred about 5:00 p. m., November 14. The hail was extraordinary; one stone weighed 7 ounces. No material damage was done to property, except a few minor roofs were blown off and damaged by hailstones. Some live stock and poultry were injured.

*Montgomery, Montgomery County, Ala.*—Weather Bureau: Thunder was heard at Montgomery at 4:20 p. m. and again at 9:45 p. m. Rain began at 5:42 p. m. and continued at intervals until after midnight; 2.69 inches of rain fell from 5:42 p. m. to 11:00 p. m. Hail fell from 6:00 p. m. to 6:04 p. m., and again from 10:10 p. m. to 10:15 p. m. The hailstones in both instances were about the size of peas. No damage was done and hail melted soon after it fell.

The thunder and hail conditions began in the northwestern portion of the area between 2:00 p. m. and 4:00 p. m., and extended to the southeastern portion by 7:00 p. m., November 14.

## GREAT RAINSTORM AT MOUNT WILSON, CALIF., DEC. 17-21, 1921.

By WENDELL P. HOGE, Special Observer

[Mt. Wilson, Calif., Jan. 10, 1922.]

The biggest rainstorm that has occurred at Mount Wilson, Calif. (elevation 5,704 feet) since rainfall observations were begun nearly 18 years ago, was recorded during the latter part of December 1921. Rain began falling at 6:40 p. m. December 17 and continued with but one interruption of 60 minutes, until 8:40 a. m. December 21, giving a total precipitation for the period of 21.88 inches. Beginning again at 2:00 a. m., the 22d, 1.15 inches was recorded up to noon the 23d.

What was apparently a second storm began with snow about 2:00 a. m. the 25th, turned to rain shortly after and continued without interruption until 4:40 p. m. the 27th, adding 6.35 inches, making a grand total for the 9 days and 22 hours of 29.38 inches.

The heaviest continuous downpour occurred from 3:00 a. m. to 3:00 p. m. the 19th, during which time 8.50 inches was recorded. The greatest amount for 1 hour was 1.25 inches, 9:10 to 10:10 a. m. the 19th. At 8:45 a. m. the 19th rain fell for 8 minutes at the rate of 2.40 inches per hour.

A standard 8-inch rain-gauge collector rests on the roof of a low one-story building, which is located within a few feet of the summit of the mountain, and near the edge of a very steep slope running off toward the south. A copper pipe leads from the collector down to a Marvin automatic recorder in the room below. A 16-candle electric lamp is placed under the collector on the roof, and the current turned on when snow falls. This gives enough heat to melt the snow, thus making a continuous record. Four and one-half inches of snow fell during the storm, which was all melted from the ground before the rain ceased.

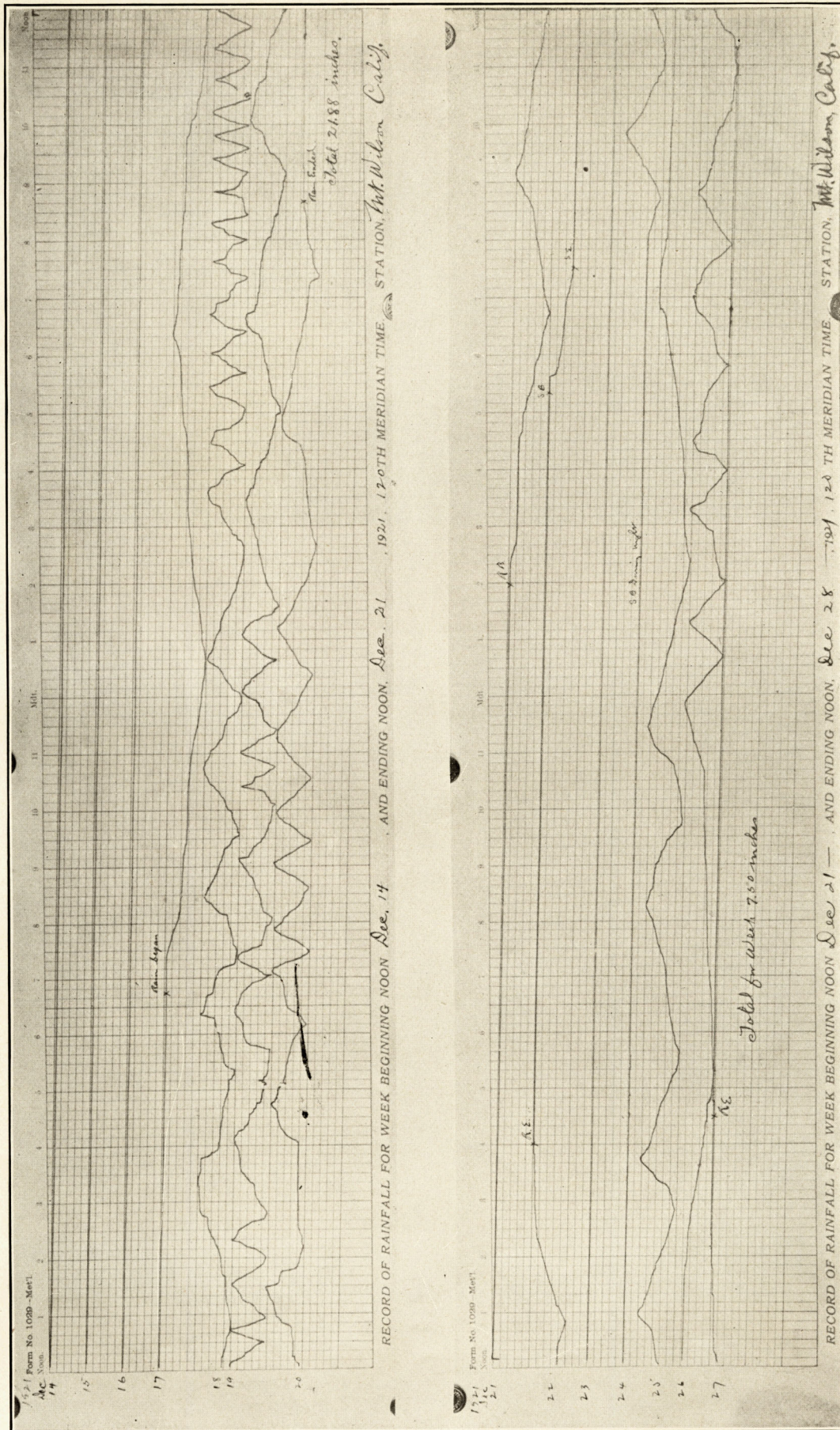


FIG. 1.—Record of Marvin Float Gage, Mount Wilson, Calif., Dec. 14-28, 1921.

The Marvin recorder gave a very perfect record, which is shown in the accompanying photograph of two sheets covering the two-week period, from noon December 14, to noon December 28.

The wind during the entire storm held steadily from S. to SSE., with an unusually high velocity, running 40, 50, and 60 miles per hour, reaching a maximum for a few minutes at one time of 80 miles per hour.

The temperature ranged from 40° to 45° day and night, dropping once to 22°, rising to the former figures again in a short time.

The runoff was rapid and as soon as the weather cleared the Santa Ana, San Gabriel, and Los Angeles

Rivers could be plainly seen from the mountain top, spreading their waters out over the level lands adjacent to those streams, inundating many low-lying farms for a distance of 20 or 30 miles inland from the sea.

This storm came after a long period of dry weather, which is characteristic of this region. Only 1.48 inches had fallen since May 23, 1921.

A simple computation helps one to realize what an enormous amount of water falls to the ground from the clouds during such a storm. A fall of 29.38 inches of rain means 152.5 pounds of water to every square foot of surface, 33,214 tons per acre and 21,257,280 tons per square mile.

#### STORM OF NOVEMBER 19-22 IN OREGON, WASHINGTON, AND IDAHO, AND STORMY PERIOD FOLLOWING.

551.515 (795) (797)  
(796)

EDWARD LANSING WELLS, Meteorologist.

[Weather Bureau, Portland, Oreg., Jan. 9, 1922.]

A period of unusually stormy weather in the Pacific Northwest began with a sudden drop in temperature in eastern Washington on November 19, 1921, and closed with high wind and a remarkable rise in pressure on December 1 and 2. Prominent features of this stormy period were: a destructive ice storm from the vicinity of Portland eastward to the Columbia River Gorge on November 19 and 20; a very heavy fall of sleet and snow along the middle Columbia, and of snow in northeastern Oregon, southeastern Washington, and north-central Idaho, and phenomenally heavy rainfall west of the Cascades, from November 19 to 22; a rapid rise in temperature beginning at Portland on the 21st and reaching interior points on the 22d; and the continuance of mild, rainy weather during the remainder of November.

Chart E. L. W.-I (upper map) shows the weather map of the morning of November 18. Two well-defined areas of high pressure are apparent, one, of a continental type, central in the interior of western Canada, and carrying low temperature, and the other central off the northern California coast, and varying mild temperature, with a shallow trough of low pressure between. The lower map shows the center of the continental anticyclone to have advanced to eastern Montana, the trough of low pressure to have moved somewhat southward, and the coast high-pressure area to have remained nearly stationary. The temperatures in the immediate vicinity of the continental high had fallen rapidly. At Spokane, Wash., a cold wave occurred, the temperature falling to -1°. This is the earliest zero weather of record at that place.

Some snow fell in eastern Washington and Oregon and northern Idaho on the 17th, but the heavy snowfall began on the evening of the 18th and continued until the 21st. At Lewiston, Idaho, the snowfall amounted to 15.9 inches, which is the greatest November snowfall of record, and is within half an inch of the average annual snowfall for that place. At Walla Walla, Wash., the snowfall amounted to 19.9 inches, which is the greatest November snowfall of record at that place. On the evening of the 20th the total depth of snow on the ground at Walla Walla was 18.2 inches, which is, with one exception, the greatest depth of record at Walla Walla.

Along the middle reaches of the Columbia River the snowfall was greater, reaching a total of 54 inches of snow and sleet at The Dalles, Oreg.

In the gorge where the Columbia River passes through the Cascade Mountains the precipitation was largely in the form of sleet, which rolled down the steep slopes and

accumulated many feet in depth in places on the Columbia River Highway and on the tracks of the O.-W. R. & N. Co., and the S. P. & S. R. R. Co. Many automobiles and several trains were stalled. Railroad service was restored in a few days, but at this writing, January 9, the highway is still blocked. The tremendous pressure of the masses of frozen sleet sliding down into the gorge caused some damage to the reinforced concrete viaducts on the highway.

From the Columbia River gorge to the lower Willamette Valley the storm took the form of unusually heavy rain, partly freezing as it fell, forming a heavy coating of ice on trees, poles, wires, and roofs. Sleet and ice were experienced to some extent over large areas in eastern and southern Washington and northern Oregon, and to a limited extent in north-central Idaho, but the deposit of ice was greatest from the Columbia River gorge to the vicinity of Portland. Street-car service was obstructed, power, telephone, and telegraph lines running east from Portland were almost completely ruined, and at one time 9,000 telephones in Portland were out of commission.

The lowest temperature reached at the Weather Bureau office in Portland was 29°, on the 20th, and by the evening of the 20th the temperature had risen above the freezing point and the ice in the business district had disappeared. In the eastern portion of the city it did not disappear till the afternoon of the 21st.

During the prevalence of the ice storm the wind at Portland was almost constantly from the east. Shortly before 4 p. m. on the 21st it was noted that the lower clouds, which had been moving from the east, were moving rapidly from the southwest, and in a few minutes the wind changed to south, increasing in force. In half an hour the temperature had risen from 40° to 56°.

This sudden rise in temperature reached eastern Washington, northeastern Oregon, and northern Idaho about 12 hours later, but was not felt in southern Oregon, southeastern Oregon, southern Idaho, nor on the coast. Thermograph traces from selected stations are shown in figure 1. The rise in temperature was greatest at Walla Walla, Wash., amounting to 32° in five hours.

Figure 2 shows the distribution of precipitation in Oregon for the four-day period, November 19-22. The precipitation reached a maximum of 13.03 inches at Zigzag Ranger Station, near Welches, on the west slope of Mount Hood, at an elevation of 1,435 feet.

At that place there was only 1 inch of snowfall, at and Government Camp, the highest station in northwestern Oregon, elevation 3,890 feet, the total snowfall for the